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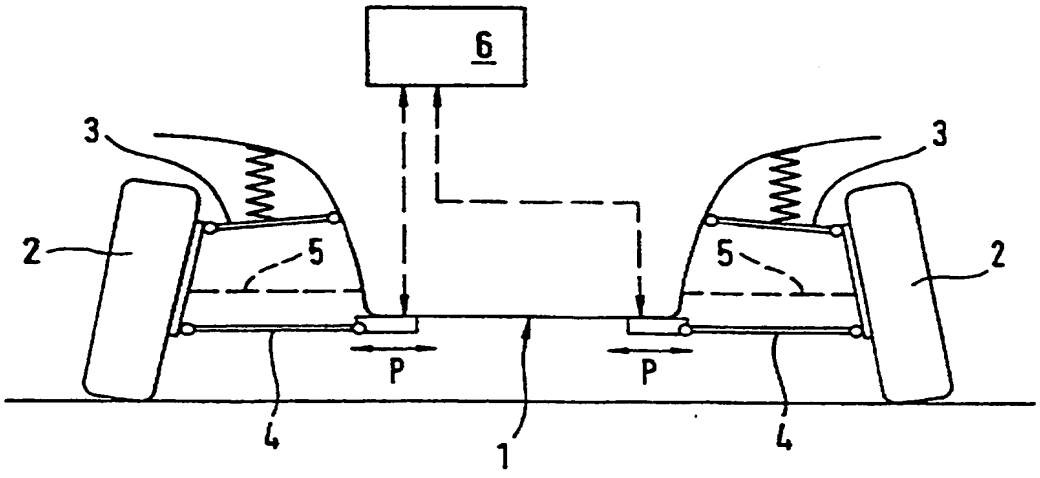
(54) Abstract Title

A motor vehicle with an actuator system for adjusting the camber of vehicle wheels

(57) In a non-track-bound motor vehicle with an actuator system for adjusting the camber of vehicle wheels (2), a sensor system (6) is provided to control the actuator system. The sensor system (6) automatically controls differences between a driving state desired by the driver of the vehicle and an actual driving state and/or as a function of driving parameters such as steering angle, yaw rate, transverse acceleration and vehicle speed, detected by means of the sensor system (6), in such a way that there is greater resistance to any tendency of the vehicle to break away transversely as recorded by the sensor system(6). The actuator system also has the capacity to compensate for low tyre inflation pressure by changing the camber.



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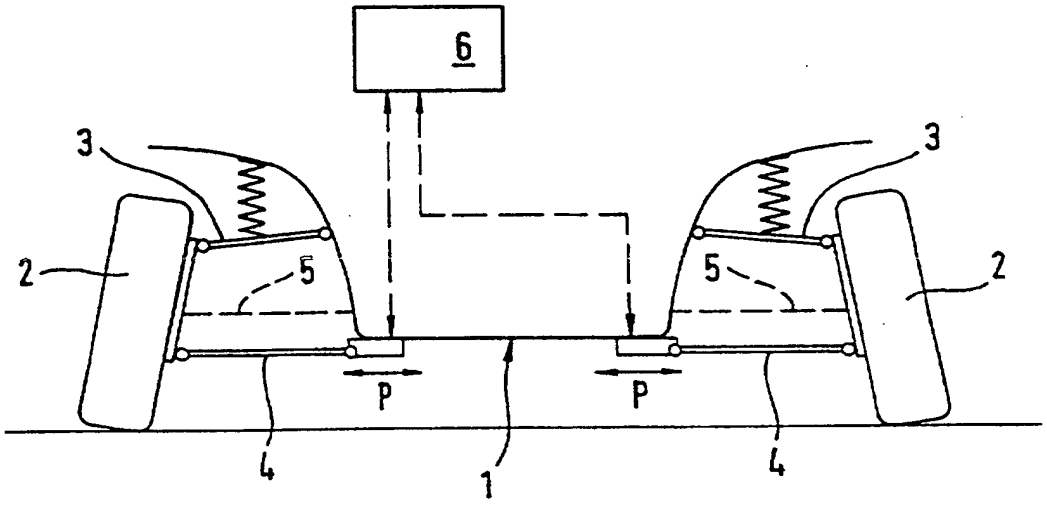
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Motor vehicle with an actuator system for adjusting the camber of vehicle wheels

The invention relates to a non-track-bound motor vehicle with an actuator system for adjusting the camber of vehicle wheels.

There are already motor vehicles on which the ground clearance of the vehicle body can be varied, provision being made to reduce the ground clearance automatically or in response to driver command at very high vehicle speed in order to increase driving stability. In general, such changes in the level of the vehicle body are also combined with variation of the camber of the wheels to a greater or lesser extent such that, as the ground clearance is reduced, the camber is increasingly negative, i.e. looking at the vehicle in the longitudinal direction, the vehicle wheels occupy a more or less pronounced inwardly inclined position (the wheel contact points are further away from the vertical longitudinal centre plane of the vehicle than the centres of the wheels).

Also known, for example from DE 197 38 826 A1, are non-track-bound vehicles which tilt on bends, which have an actuator system for the purpose of varying the roll angle of the vehicle body and simultaneously varying the sideways slope of the vehicle wheels such that both the vehicle body and the vehicle wheels tilt towards the inside of a bend when cornering, as when a single-track vehicle is cornering.

Modern vehicles have many and various electronic systems for improving driving safety in critical situations. For example, the brake systems of today's vehicles often have an anti-lock control system, with the result that individual wheels are to a very large extent prevented from locking up during braking, and the vehicle remains steerable.

Also known are traction control systems, which, on the one hand, brake a spinning driven wheel and, on the other hand, can also intervene in the vehicle drive such that the driving torque of the vehicle engine is reduced. In this way, driving stability can be significantly improved on a slippery surface.

Also known are stability control systems which check whether the vehicle is following adequately the steering movements made by the driver at the steering wheel. If relatively large deviations occur, a different braking intervention can be made at each wheel, if appropriate in combination with an intervention in the drive control, in order to match the actual path of motion of the vehicle better to the steering commands of the driver.

It is then the object of the present invention to achieve yet a further increase in the driving safety of the vehicle.

According to the present invention there is provided a non-track-bound motor vehicle with an actuator system for adjusting the camber of vehicle wheels and with a sensor system which controls the actuator system as a function of differences, detected by means of the sensor system, between a driving state desired by the driver and an actual driving state and/or as a function of parameters, detected by means of the sensor system, in such a way that there is greater resistance to any tendency of the vehicle to break away as recorded by the sensor system.

The invention is based on the general idea of automatically varying the camber of the vehicle wheels or individual vehicle wheels if it is thereby possible to achieve an improvement in driving safety in a driving situation.

For example, the camber of the vehicle wheels can be controlled as a function of the yaw rate of the vehicle and/or of changes in the transverse velocity of the vehicle, with the result that the vehicle follows even comparatively extreme steering movements by the driver comparatively well.

If, for example, the vehicle threatens to break away in a sideways direction in a particular driving situation, the camber of the vehicle wheels can be varied automatically in such a way that there is greater resistance to drift in this sideways direction.

The invention offers the advantage that the necessary sensor system is already present on modern vehicles for carrying out anti-lock control of the brakes, traction control of the driven wheels and/or the stability control described at the outset. In the case of the invention, this sensor system then additionally serves to control the camber of vehicle wheels.

The invention is explained in greater detail below with reference to the drawing, in which a preferred embodiment of the invention is illustrated schematically.

The single figure shows a schematic front view of a motor vehicle.

As shown in the drawing, wheels 2 are attached to the chassis or body 1 of a vehicle in a fundamentally known manner by means of an upper and a lower control arm 3 and 4 in a manner which allows resilient deflection, it being possible for the wheels 2 to be driven via half shafts 5 indicated only in schematic form.

According to the invention, provision is made for the camber of the wheels 2 to be variable.

For this purpose, the chassis abutments of the lower control arms 4 in the example illustrated can be adjusted in accordance with the arrows P out of the position illustrated, in which the wheels 2 have a negative camber, into a position displaced towards the axial centre,

the wheels 2 thus being guided with a positive camber. It is furthermore also possible for the negative camber to be increased if appropriate.

The camber is controlled in a manner dependent on a sensor system 6, which detects a wide variety of parameters associated with driving operation, e.g. the steering angle selected by the driver at the steering wheel, the yawing movements of the vehicle body 1, that is to say its rotation about its vertical axis, the transverse acceleration of the vehicle and the rotational speeds of all the vehicle wheels 2 and/or the vehicle speed, it being possible to determine the latter also from the rotational speeds of the wheels.

From these data, the sensor system 6 can determine whether there is a critical driving situation, in which the wheels 2 on one or more axles could break away.

If such a state of the vehicle occurs, the sensor system 6 adjusts the camber of the wheels 2, with the result that they pose a greater resistance to the respective tendency to break away.

If, for example, the vehicle is tending to break away to the right in the drawing, the camber of the wheel 2 on the right in the drawing and, if appropriate also, the camber of the wheel 2 on the left in the drawing can be adjusted to produce pivoting in the anticlockwise direction, i.e. the chassis abutments of the lower control arms 4 are displaced to a greater or lesser extent to the right in the drawing, relative to the body 1.

There is furthermore the possibility of varying the camber of the wheels 2 as a function of the vehicle speed by setting the wheels 2 to an increased negative camber at high vehicle speed, i.e. the points of contact between the wheels and the roadway are moved further apart in the transverse direction of the vehicle. The result is that the suspension is set up in a "sportier" way.

In combination with the electronic control systems described at the outset, the invention can provide a further significant increase in driving safety since the lateral guiding forces of the wheels 2 can be increased by changing the camber.

In this context, it is advantageous that the reduced lateral guidance provided by tyres with an inadequate inflation pressure can be compensated for by means of the invention.

Claims

1. A non-track-bound motor vehicle with an actuator system for adjusting the camber of vehicle wheels and with a sensor system which controls the actuator system as a function of differences, detected by means of the sensor system, between a driving state desired by the driver and an actual driving state and/or as a function of parameters, detected by means of the sensor system, in such a way that there is greater resistance to any tendency of the vehicle to break away as recorded by the sensor system.

2. A motor vehicle according to Claim 1, wherein, during high-speed cornering, the vehicle wheels on the outside of the bend are set to an increased negative camber.

3. A motor vehicle according to Claim 2, wherein, during high-speed cornering, the vehicle wheels on the inside of the bend are set to an increased positive camber.

4. A motor vehicle according to any one of Claims 1 to 3, wherein low tyre inflation pressure is compensated for by changing the camber.

5. A non-track-bound motor vehicle with an actuator system for adjusting the camber of vehicle wheels, substantially as described herein with reference to and as illustrated in the accompanying drawings.

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Claims searched: 1-5
Examiner: Kevin Hewitt
Date of search: 12 October 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B7D (DAGC, DAGX)

Int Cl (Ed.7): B62D 17/00

Other: Online WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2272406 A	(MITSUBISHI) Whole document relevant, especially actuators 2,4,6 and 8 in Fig.1	1,4 at least
X	EP 0340823 A1	(ALFA LANCIA) See Figs.1 and 2.	1,4 at least
X	US 4700972 A	(YOUNG) Whole document relevant, especially Fig.3	1-4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.